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Patentanmeldung Nr. | Patent application No. | Demande de brevet n°

98305811.6

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Page 2 de l'attestation

Anmeldung Nr.:
Application no.:
Demande n°: 98305811.6

Anmeldetag:
Date of filing:
Date de dépôt: 21/07/98

Anmelder:
Applicant(s):
Demandeur(s):
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Bezeichnung der Erfindung:
Title of the invention:
Titre de l'invention:
Method and system for signalling

In Anspruch genommene Priorität(en) / Priority(ies) claimed / Priorité(s) revendiquée(s)

Staat: State: Pays:	Tag: Date: Date:	Aktenzeichen: File no. Numéro de dépôt:

Internationale Patentklassifikation:
International Patent classification:
Classification internationale des brevets:
H04J3/12, H04B7/26

Am Anmeldetag benannte Vertragstaaten:
Contracting states designated at date of filing: AT/BE/CH/CY/DE/DK/ES/FI/FR/GB/GR/IE/IT/LI/LU/MC/NL/PT/SE
Etats contractants désignés lors du depôt:

Bemerkungen:
Remarks:
Remarques:
The application was transferred from the original applicant Lucent Technologies Network Systems GmbH to the above-mentioned applicant on 24.12.1998

METHOD AND SYSTEM FOR SIGNALLING

TECHNICAL FIELD

The present invention relates generally to the field of signalling of information, and particularly to a method and a system for signalling information in transmission systems.

BACKGROUND OF THE INVENTION

In transmission systems like radio networks, e. g. digital cellular radio networks according to the GSM-standard (Global System for Mobile communications), not only user data, e. g. encoded speech signals, are transmitted but also various information necessary for the operation of the network. The transmission of these information often is referred to as signalling. Signalling messages allow the fixed part of the network to discuss management of several issues either related to the user, e. g. call in progress indications, or concerning technical aspects of the communication, e. g. preparation and execution of a handover, with the mobile part of the network. The establishment and the release of a call also require signalling exchanges. In addition, signalling exchanges are even needed in cellular radio networks between fixed components of the network and mobile stations when no communication or call is in progress.

In order to transmit signalling information in parallel with the transmission of a user data flow, GSM offers two possibilities. Each traffic channel (TCH) for transporting the user data has an associated low rate channel, used for the transport of signalling

called slow associated control channel (SACCH). It is used for non-urgent procedures, mainly the transmission of the radio measurement data needed for the decisions concerning handover. Other needs of associated signalling, e. g. authentication or the command to handover, make use of the TCH itself, called fast associated signalling. For fast associated signalling a so called stealing flag is used, which indicates that a part of the information or data contained in the indicated TCH frame contains signalling information. The stealing flag indicates that either the first half or the complete TCH frame contains signalling information.

The known methods for signalling information in a radio network do have certain disadvantages, like the use of an additional channel, e. g. the SACCH channel. It is an other disadvantage, that if the traffic channel itself is used, at least half of the bits of each TCH frame are used for signalling and therefore are no longer available for the transmission of user data. It is a further disadvantage that signalling information being transmitted within one frame is susceptible to errors being caused by bad transmission conditions.

SUMMARY OF THE INVENTION

Accordingly, it is an object of the present invention to provide a method for signalling of information. It is the aim of the inventive method under consideration to avoid the drawbacks known from the state of the art.

The object is achieved by providing a method for signalling of information in a frame based transmission system, whereat the signalling information contains information necessary for the operation of the transmission system, having steps of

inserting signalling information related to individual frames into said individual frames, and

partitioning signalling information and inserting said partitioned signalling information into different frames.

It is an other object of the present invention to provide a system for signalling of information. It is the aim of the inventive system under consideration to avoid the drawbacks known from the state of the art.

The object is achieved by providing a frame based transmission system for signalling of information, whereat the signalling information contains information necessary for the operation of the transmission system, having means for coding and decoding of data, means for handling the coded data in frame format, and means for transmitting and receiving the frames, characterised by

means for inserting and evaluating signalling information into and from individual frames related to said individual frames, and

means for partitioning signalling information and inserting and evaluating said partitioned information into and from different frames

It is an advantage of the present invention, that it facilitates highly protected and highly reliable signalling requiring only a minimum of bits. It is an other advantage of the present invention, that it easily allows the detection of the signalling bits as the synchronisation already available from the transmission system and the frame structure of the transmission system is used for the signalling information.

The present invention will become more fully understood from the detailed description given hereinafter and further scope of applicability of the present invention will become apparent. However, it should be understood that the detailed description is given by way of illustration only, since various changes and modifications within the spirit and scope of the invention will become apparent to those skilled in the art.

BRIEF DESCRIPTION OF THE DRAWINGS

The following detailed description is accompanied by drawings of which

Fig. 1 represents a data structure for signalling information according to this invention,

Fig. 2 represents a signalling example according to the data structure of Fig. 1 in greater detail, and

Fig. 3 represents a schematic diagram of a system for signalling information according to this invention.

DETAILED DESCRIPTION

Following, the inventive method and system for signalling of information are explained with reference to a cellular radio network according to the GSM standard. However, it should be understood, that the present invention also is applicable to other transmission systems. The GSM standard is well known, see e. g. „The GSM System for Mobile Communications", M. Mouly, M.-B. Pautet, Palaiseau, 1992, ISBN 2-9507190-0-7, which is incorporated by reference herein.

The information which is signalled characterises different codec modes for coding and decoding source coded user data, i. e. speech, in this example and will be referenced as adaptive multirate coding (AMR). The AMR principle is used for modelling a transmission system that shows graceful degradation in case of deteriorated transmission conditions. If the transmission conditions deteriorate the bit rate used for transmission of source coded user data, e. g. speech, is decreased and the bit rate used for channel coding, i. e. the protection of the user data, is increased. Several AMR modes can be used, depending on the deterioration of the transmission conditions. In the moment there are defined four modes plus two additional modes for expansion. Greater detail of AMR can be found in „Adaptive Multi-Raten Sprachcodierung für zukünftige GSM-Systeme", Karl Hellwig, ITG-Fachtagung 3.-5. March 1998, Aachen, ITG-Fachbericht 146, pages 173-176, which is incorporated by reference herein. Other signalling aspects of AMR, e. g. signalling

for the selection of one of the available channel types, half rate or full rate, will not be explained in the following, as these aspects are not relevant for the understanding of the present invention.

Fig. 1 shows a data structure for signalling information according to the present invention, especially information on the AMR coding mode called coding mode in the following. The structure shown represents the signalling from the fixed part of the radio network to the mobile part, i. e. data are transmitted from the fixed part to the mobile part. User data, i. e. speech, is being source coded in a speech coding step 101 using one mode of available modes for speech coding according to the selected coding mode. By example, six different coding modes can be used. In this case three bit are necessary for coding the six different coding modes. When the transmission is started the preselected coding mode can be the coding mode offering the lowest bit rate for speech. The coding mode can be changed if necessary as will be explained later. According to the selected coding mode the speech coded data from step 101 is channel coded together with at least one additional bit derived form a multiframe signalling step 102 in a channel coding step 104, forming speech and multiframe signalling bits 106. The additional bit from step 102 is a part of the three bit information used for coding additional signalling information. In the present example it represents the six different coding modes available or measurement information. In this example it takes three frames within a multiframe of six frames, as e. g. defined and used according to the GSM standard, to transmit the coding mode information as within each frame only one of three bits is transmitted, thus providing additional protection for the transmitted coding mode information. Due to the fact that the one bit used per frame is in addition protected by the channel coding step 104, total protection is further increased.

For each data frame actual coding mode bits are generated in an actual mode signalling step 100 according to the coding mode selected for the data frame. As explained above, for characterising the coding mode three bits are used. The coding mode bits derived from step 100 are channel coded in a channel coding step 103. For channel coding e. g. eleven additional bit are used in this example to form

fourteen actual mode bits 105. In a frame formatting and interleaving step 107 the actual mode bits 105 and the speech and multiframe bits 106 are formatted and interleaved for a transmission step T. As the bits added for signalling are inserted into the data frame structure of the transmission system, the synchronisation for the added bits is automatically provided by using the given synchronising mechanisms.

After transmission of the bits a de-interleaving step 108 is used to recover actual mode bits 109 and speech and multiframe signalling bits 110. From the actual mode bits 109 in a channel decoding step 111 the three bits for actual mode signalling 112 are recovered. From the speech and multiframe signalling bits 110 in a channel decoding step 113 the source coded user data 114, e. g. speech, and the multiframe signalling 115 are recovered.

If, depart for the above described transmission direction from the fixed part of the radio network to the mobile part (downlink) the transmission direction is reversed to the direction from the mobile part to the fixed part of the network (uplink), the actual mode bits 105 also contain the coding mode used for the respective frame as coded in the mobile part, but the multiframe signalling bits 102 transmitted in three consecutive frames contain a quality measurement of the downlink as measured by the mobile part at reception thereof. For the measured quality of the downlink eight different levels can be assigned as three bits are used for multiframe signalling.

All above used steps of coding, decoding, transmission etc. are per se well known and are explained e. g. in greater detail in the above mentioned documents.

Looking now to Fig. 2, the data structure for signalling as explained above will be explained in greater detail. Fig. 2 shows the signalling for nine consecutive data frames 0 to 8. In the example shown it is assumed that the fixed part of the network and the mobile part use the same coding mode for the transmission of data in downlink and uplink, this is also referred to a symmetrical operation. It should be noted that it is also possible that the fixed part of the network uses a coding mode for the downlink different form the coding mode used by the mobile part for uplink. In this

case an actual mode signalling codeword for the downlink is different in general compared to an actual mode signalling codeword for the uplink. The table of Fig. 2 has in its first gap the frame number of the transmitted data frame; in its second gap the three bit actual mode codeword used for signalling of the coding mode for the downlink; in its third gap the multiframe signalling bit used for characterising the coding mode command for the uplink sent in the downlink; in its fourth gap the three bit actual mode codeword used for signalling of the coding mode for the uplink; in its fifth gap the multiframe signalling bit of the uplink used for characterising the transmission quality of the downlink as received and measured by the mobile part; and in its sixth gap the action regarding change of used coding mode.

For the first three frames 0 to 2 the actual coding mode is Mode 3, characterised by bit sequence 010, for both the codewords of downlink and uplink. As no change of coding mode is necessary for the next three frames 3 to 5 the sequence of the multiframe signalling bits of the downlink also is 010, Mode 3. In the example shown in the first frame 0 the least significant bit (LSB) is transmitted while the most significant bit (MSB) is transmitted in the third frame 2. In the same way the quality measurement is signalled in the uplink, LSB in the first frame 0, MSB is the third frame 2. The sequence 110 as shown in Fig. 2 is an assumed value and merely for explanation. Within the consecutive three frames 3 to 5 it is signalled that the frames 6 to 8 will have a different coding mode. To accomplish this the bit sequence of the multiframe signalling bits is changed to 001 to represent Mode 2. For the frames 6 to 8 Mode 2 is used as coding mode.

The coding modes used both in downlink and uplink are determined by the fixed part of the network. To determine the coding modes the transmission quality of downlink and uplink are analysed. The quality of the uplink is measured by the fixed part of the network, the quality of the downlink is - as explained above - measured by the mobile part and transmitted to the fixed part of the network using the multiframe signalling bits of the uplink.

The decoding mode used in the fixed part of the network for the data received from the mobile part is determined by the actual mode signalling codeword contained in the uplink. For error checking the received codeword can be compared to a determined codeword of a previous frame, as the code mode can not change during three frames. The decoding mode used in the mobile part for the frames received from the fixed part of the network is determined by the actual mode signalling codeword contained in the downlink. In symmetrical operation, i. e. the same mode is used for downlink and uplink, the received codeword of the downlink can be compared to the mode command sent previously on the downlink during three previous frames. In that way, a very high protection for the signalled modes used for coding and decoding is achieved with a small number of bits, which is important as using different modes for coding and decoding would lead to a destruction of the user data. In case of symmetrical operation, as mentioned above, several strategies can be applied by using the proposed coding scheme of actual code mode word and the partitioned code mode bits. In case of error for, e. g. several frames, either the previous coding mode transmitted in the partitioned code mode bits can be kept for uplink and downlink or the coding mode can be decreased towards more channel coding protection of the speech bits.

Fig. 3 is a schematic diagram of a system for signalling information according to this invention. A fixed part of the network 1 and a mobile part 2 are depicted. Both parts have a source coder/decoder 10, 20, e. g. for speech, a first channel coder/decoder 11, 21, a coding mode means 12, 22, a second channel coder/decoder 13, 23, a formatting and interleaving/de-interleaving means 14, 24, a transceiver 15, 25 and an antenna 16, 26. Several other elements are used in the fixed part of the network 1 and the mobile part, e. g. a equaliser is used within the transceivers 15 and 25, for the sake of an easier understanding of the present invention this elements are not shown as they are not relevant for this invention. For greater detail of the radio network reference is made to the mentioned state of the art.

For downlink transmission, i. e. in case the fixed part 1 transmits data frames to the mobile part 2, user data, e. g. speech, is coded by speech coder 10 using a coding

mode as indicated by coding mode means 12. The output of speech coder 10 is channel coded by channel coder 11. As explained above, to the output of speech coder 10 at least one bit is added which is part of the multiframe signalling bits. The additional bit is being generated by the coding mode means 12 according to the used coding mode for the next frames. The coding mode means 12 also generates the three actual mode bits, as explained above. The actual mode bits are channel coded by channel coder 13, e. g. a block coder. The outputs of channel coders 11 and 13 are fed to the formatting and interleaving means 14 which forms a data frame for transmission, e. g. a transmission frame according to the above mentioned GSM standard. The transmission frame then is transmitted from transmitter 15 and antenna 16. At the mobile part 2 the transmitted signal, i. e. the transmission frame, is received by antenna 26 and receiver 25. The transmission frame is de-interleaved by the de-interleaver 24. The channel coded actual mode bits are coupled to the channel decoder 23. The decoded actual mode bits are fed to the coding mode means 22. The coding mode means 22 provides information on the coding mode used in each frame to the channel decoder 21 and to the speech decoder 20 for decoding each individual frame.

As explained above with reference to Fig. 1 and 2, the coding mode used at the side of the fixed part 1 of the network for coding the frame which is processed now at the mobile part 2 is identified by the coding mode means 22 analysing the actual coding mode bits as well as the multiframe signalling bits, which in this example are transmitted one bit each in subsequent frames. As also explained above, the synchronisation for bits added for signalling is automatically provided by using the given frame structure.

For uplink transmission, i. e. the mobile part 2 transmits data frames to the fixed part 1 of the network data, e. g. speech, is coded by the speech coder 20 using a coding mode as indicated by coding mode means 22. The output of speech coder 20 is channel coded by channel coder 21. As explained above, to the output of speech coder 20 at least one bit is added which is part of the multiframe signalling bits. The additional bit is being generated by the coding mode means 22 according to the

reception quality as estimated for the downlink from measurements in the mobile part 2 and the fixed 1 part of the network. The coding mode means 22 also generates the three actual mode bits indicating the coding mode used for coding of the actual frame, as explained above. The actual mode bits are channel coded by channel coder 23, e. g. a block coder. The outputs of channel coders 21 and 23 are fed to the formatting and interleaving means 24 which forms a data frame for transmission, e. g. a transmission frame according to the above mentioned GSM standard. The transmission frame then is transmitted from transmitter 25 and antenna 26. At the fixed part 1 of the network the transmitted signal, i. e. the transmission frame, is received by antenna 16 and receiver 15 which e. g. also measures the quality of the uplink. The transmission frame is de-interleaved by the de-interleaver 14. The channel coded actual mode bits are coupled to the channel decoder 13. The decoded actual mode bits are fed to the coding mode means 12. The coding mode means 12 provides information on the coding mode used in each frame to the channel decoder 11 and to the speech decoder 10 for decoding each individual frame.

As explained above with reference to Fig. 1 and 2, the coding mode used at the side of the mobile part 2 for coding the frame which is processed now at the fixed part 1 of the network is identified by the coding mode means 12 analysing the actual coding mode bits as well as the previously decided coding mode for the uplink. As mentioned before, the coding modes for uplink and downlink are decided at the side of the fixed part 1 of the network based on the transmission quality for uplink and downlink. As also explained above, the synchronisation for bits added for signalling is automatically provided by using the given frame structure.

CLAIMS

1. A method for signalling of information in a frame based transmission system, whereat the signalling information contains information necessary for the operation of the transmission system,
characterised by steps of
inserting signalling information related to individual frames into said individual frames, and
partitioning signalling information and inserting said partitioned signalling information into different frames.

2. A method according to claim 1,
characterised in, that
said inserted signalling information and said inserted partitioned signalling information is synchronised by using the given synchronisation of the frame based transmission system.

3. A method according to claim 1 or 2,
characterised in, that
said signalling information and said partitioned signalling information indicate a coding mode used for coding and decoding data in the transmission system.

4. A method according to one of the claims 1 to 3,
characterised in, that
said inserted signalling information related to individual frames indicates a coding mode used for coding and decoding data in the transmission system,
said partitioned signalling information inserted into different frames of the uplink is a quality criterion for the transmission, and

said partitioned signalling information inserted into different frames of the downlink indicated a coding mode used for coding and decoding data in the transmission system.

5. A method according to one of the claims 1 to 4,
characterised in, that
said inserted signalling information related to individual frames is channel coded separately.

6. A method according to one of the claims 1 to 5,
characterised in, that
said partitioned signalling information inserted into different frames is channel coded together with data contained in said different frames.

7. A method according to one of the claims 1 to 6,
characterised in, that
the transmission system is a radio network system.

8. A method according to claim 7,
characterised in, that
said radio network system is a GSM system.

9. A frame based transmission system for signalling of information, whereat the signalling information contains information necessary for the operation of the transmission system, having
means for coding and decoding of data (10,11;20,21),
means for handling the coded data in frame format (14;24), and

means for transmitting and receiving the frames (15,16;25,26),

characterised by

means for inserting and evaluating signalling information (12;22) into and from individual frames related to said individual frames, and

means for partitioning signalling information (12;22) and inserting and evaluating said partitioned information into and from different frames.

10. A system according to claim 9,

characterised in, that

means for synchronising (10,11,14;20,21,24) are used to synchronise said inserted signalling information and said inserted partitioned signalling information according to the given synchronisation of the frame based transmission system.

11. A system according to claim 9 or 10,

characterised in, that

means for channel coding and decoding (13;23) are used to channel code and decode the signalling information provided by said means for inserting and evaluating signalling information (12;22) into and from individual frames.

12. A system according to one claim 9 to 11,

characterised in, that

the means for coding (11;21) are used to channel code and decode the signalling information provided by said means for partitioning signalling information (12;22) and inserting and evaluating said partitioned information into and from different frames.

13. A system according to one of the claims 9 to 12,
characterised in, that
the transmission system is a radio network system.

14. A system according to claim 13,
characterised in, that
said radio network system is a GSM system.

15. A system according to one of the claims 9 to 14,
characterised in, that
said signalling information provided by said means for inserting and evaluating signalling information (12;22) into and from individual frames and said signalling information provided by said means for partitioning signalling information (12;22) and inserting and evaluating said partitioned information into and from different frames indicate coding modes used by the means for coding and decoding (10,11;20,21).

16. A system according to claim 15,
characterised in, that
said system is a fixed part (1) of said radio network system.

17. A system according to on of the claims 9 to 16,
characterised in, that
said signalling information provided by said means for inserting and evaluating signalling information (12;22) into and from individual frames indicate coding modes used by the means for coding and decoding (10,11;20,21), and
said signalling information provided by said means for partitioning signalling information (12;22) and inserting and evaluating said partitioned information into and from different frames indicate a quality criterion for transmission.

18. A system according to claim 17,
characterised in, that
said system is a mobile part (2) of said radio network system.

19. A system according to claim 18,
characterised in, that
said quality criterion for transmission is evaluated by said mobile part (2) of said radio network system, based on frames received from said fixed part of said radio network system.

METHOD AND APPARATUS FOR SIGNALLING INFORMATION

ABSTRACT

The present invention relates generally to the field of signalling of information, and particularly to a method and a system for signalling information in transmission systems.

Methods for signalling information in transmission systems do have certain disadvantages, like the use of an additional channel for signalling or the use of a big number of bits for signalling.

The present invention facilitates highly protected and highly reliable signalling requiring only a minimum of bits by inserting an individual signalling information into individual frames and by additionally partitioning signalling information and inserting the partitioned signalling information into different frames, i. e. spreading the signalling information.

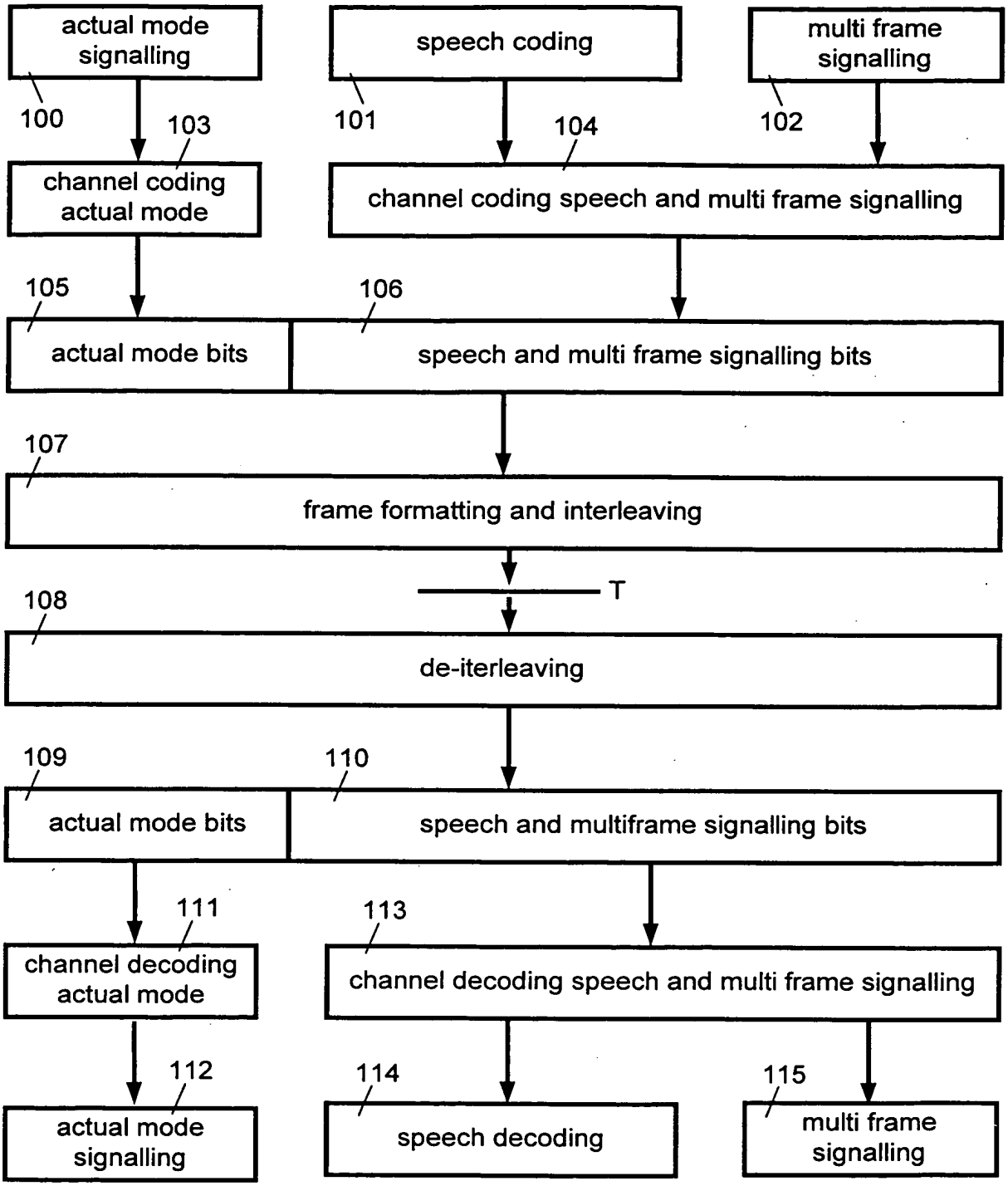
actual mode signalling
speech coding
multi frame signalling
100
101
102
103
104
channel coding actual mode
channel coding speech and multi frame signalling
105
106
actual mode bits
speech and multi frame signalling bits
107
frame formatting and interleaving
T
108
de-iterleaving
109
110
actual mode bits
speech and multiframe signalling bits
111
113
channel decoding actual mode
channel decoding speech and multi frame signalling
112
114
115
actual mode signalling
speech decoding
multi frame signalling

Fig. 1

Frame Number	actual mode signalling codeword for downlink	mode Command bit for downlink	actual mode signalling codeword for uplink	Quality measure-ment bit for uplink	Action
0	010 (Mode 3)	0 (LSB)	010 (Mode 3)	0 (LSB) (assumed)	no change of codec mode
1	010 (Mode 3)	1	010 (Mode 3)	1 (assumed)	no change of codec mode
2	010 (Mode 3)	0 (MSB)	010 (Mode 3)	1 (MSB) (assumed)	no change of codec mode, mode command word collected, quality word collected (=110)
3	010 (Mode 3)	1 (LSB)	010 (Mode 3)	1 (LSB) (assumed)	change of codec mode 3 to 2
4	010 (Mode 3)	0	010 (Mode 3)	0 (assumed)	change of codec mode 3 to 2
5	010 (Mode 3)	0 (MSB)	010 (Mode 3)	1 (MSB) (assumed)	change of codec mode 3 to 2, mode command word collected, quality word collected (=101)
6	001 (Mode 2)	1 (LSB)	001 (Mode 2)	1 (LSB) (assumed)	change of codec mode 2 to 4
7	001 (Mode 2)	1	001 (Mode 2)	1 (assumed)	change of codec mode 2 to 4
8	001 (Mode 2)	0 (MSB)	001 (Mode 2)	1 (MSB) (assumed)	change of codec mode 2 to 4, mode command word collected, quality word collected (=111)

Fig. 2

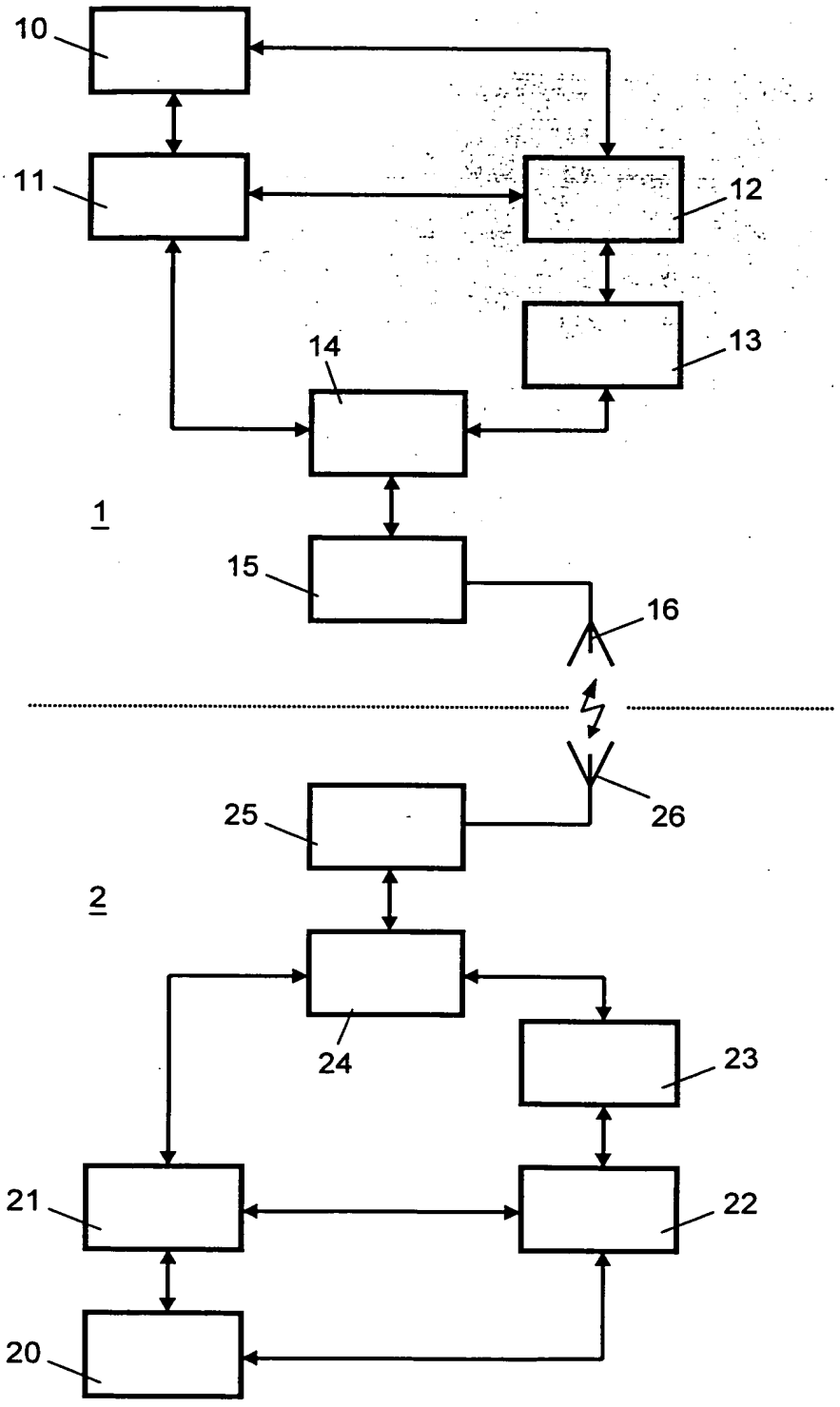

Fig. 3